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*Therefore, this*

**United States Patent**

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*Director of the United States Patent and Trademark Office*



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Korkmaz et al.

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(54) **AUTOMATIC TRANSMISSION FOR MOTOR VEHICLES**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(58) Field of Search ..... **475/275, 276**

(56) **References Cited**

#### U.S. PATENT DOCUMENTS

4,070,927 A 1/1978 Polak ..... 74/765  
4,939,955 A 7/1990 Sugano ..... 475/278  
5,250,011 A \* 10/1993 Pierce ..... 475/276

5,295,924 A 3/1994 Beim ..... 475/275  
5,435,792 A 7/1995 Justice et al. .... 475/276  
5,460,579 A 10/1995 Kappel et al. .... 475/276  
5,533,945 A 7/1996 Martin et al. .... 475/276  
5,536,220 A 7/1996 Martin ..... 475/275

#### FOREIGN PATENT DOCUMENTS

DE 38 25 733 A1 2/1989 ..... B60K/17/08  
DE 42 24 361 A1 1/1993 ..... F16H/3/62  
DE 38 25 733 C2 7/1996 ..... F16H/3/62  
EP 0 719 961 A2 7/1996 ..... F16H/3/66  
JP 04290649 10/1992 ..... F16H/3/62  
JP 08200456 8/1996 ..... F16H/3/62  
JP 10259861 9/1998 ..... F16H/3/66  
WO 96/01381 1/1996 ..... F16H/3/62

\* cited by examiner

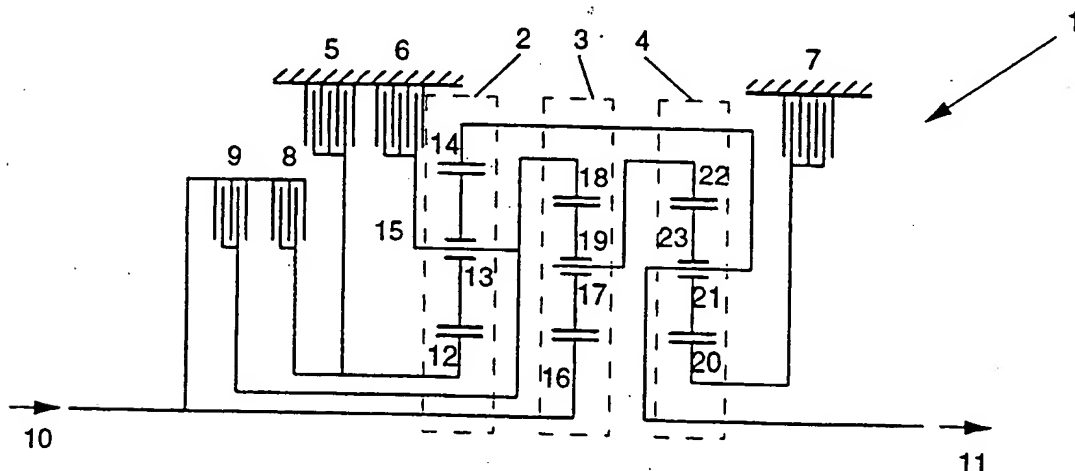
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(57) **ABSTRACT**

The invention concerns a transmission (1) with automatic shifting capabilities and with three spider supported planetary sets (2, 3, 4), three brakes (5, 6, 7), and two clutches (8, 9) for the shifting of six forward moving gears and one reverse gear and having an input shaft (10) and an output shaft (11). In this way, the input shaft (10) is in continual connection with the sun gear (16) of the second planetary set (3) and the input shaft (10) is connectable to the sun gear (12) of the first planetary set (2) by means of the first clutch (8) and/or by means of the second clutch (9) is also connectable with the spider (15) of the first planetary set (2). Further, the sun gear (12) of the first planetary set (2) by means of the first brake (5) and/or the spider (15) of the first planetary set (2) by means of the second brake (6) and/or the sun gear (20) of the third planetary set (4) by means of the third brake, are all connectable with the housing of the transmission.

21 Claims, 3 Drawing Sheets



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## AUTOMATIC TRANSMISSION FOR MOTOR VEHICLES

### FIELD OF THE INVENTION

The present invention concerns a motor vehicle transmission capable of automatic shifting, with three spider mounted, planetary sets, three braking mechanisms, two couplings for six forward gear changes and one reverse gear change as well as one input drive shaft and one output drive shaft.

### BACKGROUND OF THE INVENTION

A planetary transmission of this nature has been made known by U.S. Pat. No. 4,070,927, wherein the number of the forward gears is respectively greater by one than the numbers of the frictional elements. At each gear change between the forward gears, one of the provided frictional elements is shifted in or out.

Thus, the purpose of the invention is to make available a new and improved transmission, which avoids the known faults and yet fulfills the above mentioned advantages. Further the purpose will include a desirable construction and arrangement of a start-up element as well as make possible a desirable design of the input and output of power.

In accord with the invention, this purpose will be achieved by a transmission for a motor vehicle with automatic shifting capabilities of the type mentioned in the introductory passages with the features of claim 1.

In accordance with the invention, this purpose will be achieved by a transmission for a motor vehicle with automatic shifting capabilities.

### SUMMARY OF THE INVENTION

In this way, an automatically shiftable vehicle transmission is available, with six forward gears, and one reverse gear which, advantageously for motor vehicles, exhibits a very well adapted gear ratio with a high over-all range and favorable gear change stages, as well as a high start-up ratio in the forward direction. Further the fifth gear is a direct gear. A transmission of this nature is adaptable both for passenger vehicles and for commercial vehicles and characterizes itself by a modest cost of construction, that is, two clutches and three brakes, wherein, in the case of sequential shifting, double shift is avoided and thus, with any desired shifting within a group of gears, respectively only two shifting elements are changed.

The transmission in accord with the invention can be made in an advantageous manner in two versions, wherein these versions differ from one another by the varying connections within the individual planetary sets. In the first version, provision is made, that the power take-off shaft is continually connected to the spider of the third planetary gear set and with the internal gear of the first planetary set. Provision is further made, in that the spider of the first planetary set is continually connected to the internal gear of the second planetary set and the spider of the second planetary set is continually connected with the internal gear of the third planetary set.

The power input drive shaft and the power output drive shaft can, in this design, be coaxial with one another in opposite sides of the transmission housing as well as on the same side of the said transmission housing. Further, a placement of the power takeoff drive between the planetary sets and the clutches is possible.

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In a development in accord with a second version: the power takeoff drive is continually in connection with the spider of the second planetary set and with the internal gear of first planetary set; the spider of the first planetary set is continually in connection with internal gear of the third planetary set 4, and the internal gear of the second planetary set is continually in connection with the spider of the third planetary set. A design of this kind is especially well adapted for a coaxial arrangement of power input and power take-off shafts.

A development of the invention proposes, that the first clutch be activated in the first and fifth gear, as well as the reverse gear, and that the second clutch is activated in the fourth, fifth and sixth gear.

The first brake is activated in the second and sixth gear, the second brake is available for the first and reverse gears and the third brake is activated in the first, second, third and fourth gear. In this way, the achievement is advantageously made, that each time, only one shifting element for each optional shift between the first and the fourth gear, between the third and fifth gear and between the fourth and sixth gear is changed. Thus, when sequential shifting is carried out, double shifting is avoided.

Further goals, features, advantages, and application possibilities of the invention are made known from the following description of an embodiment example, which is more closely detailed by reference to the drawings. In this way, all described and/or illustrated features, of themselves, or in optional, advantageous combination, form the object of the invention, independently from their condensation in the claims and the inter-references of said claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 in schematic presentation, a transmission with coaxial power input and output in accord with a first version,

FIG. 2 in schematic presentation, a transmission with coaxial power input and output in accord with a second version,

FIG. 3 in schematic presentation, a transmission in accord with the first version with the power input on the power output side,

FIG. 4 in schematic presentation, a transmission in accord with the first version, with power output between the planetary sets and the clutches;

FIG. 5 in schematic presentation, a transmission with a torque converter for a standard transmission assembly,

FIG. 6 in schematic presentation, a transmission in accord with the first version, however, in mirror image arrangement with integrated start-up braking for a front-cross-arrangement in passenger car,

FIGS. 7, 8, 9 example series of gear ratios for a transmission in accord with FIG. 1,

FIGS. 10, 11 example series of gear ratios for a transmission in accord with FIG. 2, and

FIG. 12 a flow diagram for a transmission in accord with the invention.

### DETAILED DESCRIPTION OF THE INVENTION

The internal gear 14 of the first planetary set 2 stands continually in connection with the spider 23 of the third planetary set 4 and, in turn, this spider 23 is continually in